Surveillance of Acute Flaccid Paralysis

FIELD GUIDE

MCH DIVISION
DEPARTMENT OF FAMILY WELFARE
MINISTRY OF HEALTH AND FAMILY WELFARE

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Foreword

The primary aim of this document is to provide public health personnel, epidemiologists, clinicians, medical officers, and other health personnel involved in the polio eradication initiative in India at national, state, and local levels, with a step-by-step guide for setting up and carrying out surveillance aimed the eradication of polio.

This document places special emphasis on issues related to identifying and reporting of cases of acute flaccid paralysis (AFP), improving specimen collection for wild poliovirus isolation, accelerating specially targeted immunization strategies, improving the diagnosis and management of acute cases.

1.0 BACKGROUND

Oral Polio Vaccine has been available for use in India since 1979. Before 1986, coverage for all antigens among infants, was estimated to be less than 50%. In 1985, the Universal Immunization Programme (UIP) was established and implemented in India. As a result of UIP efforts, in 1989 nearly 150 million doses of OPV were distributed in India and over 18 million infants received 3 doses of the vaccine. That year national coverage levels of OPV3 reached 75% and since 1990 coverage for the third dose of OPV among infants has been sustained above 85%. Similar efforts were directed at the other antigens. It is now estimated that coverage for **all** antigens among infants in India is over 85%.

Access to women and children achieved under the Universal Immunization Programme is now being utilized to further extend and intensify other services related to maternal and child health care. In August 1991, the Government of India developed and implemented the Child Survival and Safe Motherhood (CSSM) Program with the primary mission to identify and prevent 90% of the problems related to the health of underserved children and their mothers.

The goal to eradicate poliomyelitis by the year 2000 adopted under the Universal Immunization Program has retained its position of high priority under the newly formed CSSM Program.

2.0 OVERVIEW OF BASIC EPIDEMIOLOGY OF POLIOMYELITIS

The poliovirus is an enterovirus. There are three serotypes types, 1, 2, and 3. All three can cause paralysis, although type 1 causes paralysis most often, type 3 less frequently, and type 2 rarely. Most epidemics are due to type 1. Cases of paralysis associated with the vaccine are usually caused by types 3 and 2. During eradication, the first serotype to disappear is type 2 due to better OPV "take" rates, followed by serotypes 3 and 1.

Poliomyelitis exists worldwide. In temperate climates as in Europe and North America it is seasonal, occurring more commonly in summer and early autumn. In India, the incidence increases during July to September coinciding with the rainy season. Where poliomyelitis is common, 3 to 10 out of every 1,000 young children will develop paralytic disease without an immunization program.

Fecal-oral transmission is most common where sanitation is poor. One week after onset, little virus remains in the throat, but it continues to be excreted in stools for 6 to 8 weeks. Cases are most infectious during the first few days before and after the onset of symptoms.

Man is the only reservoir, and infection is spread from person to person. Given the large number of inapparent infections it is difficult to find the source of a case. A long-term carrier state is not known to occur. The half-life of excreted virus in the sewage in warm climate is only 48 hours and spread of infection through sewage can only occur during this period. These facts, apart from the properties of OPV, are the major reasons why polio is a candidate for eradication.

The incubation period from exposure to the virus till the onset of symptoms is 7-10 days (range of 4-30 days). The initial illness is followed by a few days which are relatively free of symptoms before the onset of paralysis.

All unimmunized persons are susceptible to poliomyelitis. Epidemiologic evidence shows that infants born to mothers with antibodies are protected naturally against paralytic disease for about six months. Immunity is obtained through infection by the wild virus and through immunization. Natural infection (including inapparent and mild infections) or a completed series of immunizations with live oral polio vaccine (OPV) results in both humoral and local intestinal immunity. For every child who develops paralytic poliomyelitis, it is known that between 100 to 1000 children have suffered clinically inapparent infection which stopped short of producing paralysis. The detection of even one case of polio indicates that transmission of wild polioviruses is occurring in the community. The surveillance of all cases of acute flaccid paralysis will identify the areas with high transmission of poliovirus and help in targeting the interventions.

The oral poliomyelitis vaccine (OPV) contains live attenuated polioviruses. Since the virus in the vaccine is live and is administered orally, thereby mimicking the natural route of infection, it can also be transmitted from a recently vaccinated person to close contacts who have not been immunized. The wild virus infects children mostly aged <5 years. By replacing circulation of the wild poliovirus with vaccine poliovirus the disease can be eradicated. This effect is enhanced if the vaccine is administered to the entire community at risk, i.e. children <5 years by means of mass immunization campaigns, as in the case of Pulse Polio Immunization (PPI). The success is due primarily to the emphasis placed on mass vaccination for community protection rather than on individual immunity alone. The simultaneous feeding of vaccine virus to a large group of children in the shortest possible time, gives rise to more extensive dissemination of excreted vaccine virus than occurs during epidemic cycles of natural disease. The net result is abrupt interruption of the transmission of wild poliovirus in the community, a result that cannot otherwise be achieved in areas of poor sanitation by year-round routine immunization alone. This strategy will work even in areas with low coverage through routine services as it has very little to do with individual immunity.

3.0 STRATEGIES FOR POLIO ERADICATION

The strategies used in the polio eradication program are based on knowledge about the disease, the vaccine, and effective methods for the control of polio.

Three Key Strategies

Achieve the highest coverage levels possible through the administration of vaccines in the routine immunization program. Using the routine program, reported polio cases declined 80% from 24,257 in 1988 to 4793 in 1994. However, the routine program alone will not interrupt transmission of wild poliovirus and allow India to achieve the goal of polio eradication by the year 2000.

Implement nation-wide mass immunization campaigns. To achieve the goal of eradication of wild poliovirus transmission by the year 2000, the Ministry of Health and Family Welfare of the Government of India conducted its first Pulse Polio Immunization (PPI) days on 9 December 1995 and 20 January 1996. More than 75 million children aged <3 years were targeted throughout the country to receive two doses of oral poliovirus vaccine (OPV) on these days. PPIs will be repeated yearly for at least 3-4 years, or until wild poliovirus transmission is interrupted. For the second and subsequent years, the target age group will be increased to include children aged <5 years, bringing the total target to approximately 121 million.

Strengthen surveillance of acute flaccid paralysis (AFP) so that all cases of polio are detected, reported, investigated, and controlled. The Ministry of Health and Family Welfare recognizes the urgent need to expand and maintain a surveillance system which can fully monitor the impact of PPIs in India. Otherwise, the huge investment in human and financial resources to conduct PPIs may be wasted.

4.0 POLIO VACCINE - IMPORTANT CONSIDERATIONS

There are two highly effective polio vaccines available, inactivated polio vaccine (IPV) and live attenuated trivalent oral poliovirus vaccine (OPV). IPV first became available in 1955, followed by OPV, which was first used in mass campaigns in 1958.

OPV is the vaccine of choice. When used in PPIs, it is the only proven strategy that will allow India to achieve the goal of polio eradication by the year 2000 with the rest of the world. OPV also is indicated as the only vaccine to control outbreaks. OPV induces better intestinal immunity to prevent spread of infection with wild poliovirus; logistically is much easier to administer because it is given by mouth; is much cheaper; and has the ability to induce immunity in unimmunized contacts.

Injectable polio vaccine protects against clinical disease and suppresses pharyngeal excretion of the virus, but has less of an effect on intestinal excretion and transmission of infection to other susceptible children. Vaccinating children with IPV would reduce the number of paralytic cases due to vaccine, but comparatively, would have little effect on the transmission of wild poliovirus, which in India is primarily by the oral-fecal route.

4.1 Dosage and storage

Dosage of OPV is usually 2 drops (0.1 ml) or the dosage recommended by the manufacturer. The number of recommended doses is four, usually given at 6, 10, and 14 weeks, and at the time of booster immunization with DPT vaccine. Seroconversion may be improved by increasing the number of doses. Doses should be administered at least 4 weeks apart. For purposes of the polio eradication program, there are virtually no contraindications to immunization with OPV.

OPV should be stored below 8°C at all times. It is the most heat labile vaccine in common use. Unopened vials of OPV may be stored for up to 6 months at temperatures between 0-8°C, and may be thawed and refrozen without damage. Ideally, OPV should be stored for a maximum of 3-6 months at the regional or provincial level at -20°C, and 1 month at the PHC level at +2 to +8°C.

At the PHC level, unopened vials of OPV which have been transferred from the fridge to a vaccine carrier for outreach activities should be replaced in the fridge at the end of the working day, as long as the cold chain was maintained during the outreach activities. This can be done up to three times at the most, and thereafter these vials should be discarded. Any opened vials should be discarded at the end of the session.

4.2 Administration strategies

Since no vaccine has a 100% efficacy, not all persons given OPV through the routine services will be protected against poliomyelitis. The higher prevalence of other circulating non-polio enteriviruses in countries with warmer climates is one reason why 20-30% of the children immunized with OPV may remain unprotected against poliomyelitis. Other reasons include the difficulty in maintaining adequate cold chain and hygiene. However, wild poliovirus transmission is interrupted when the community is flooded with huge numbers of vaccine polioviruses, thus displacing wild polioviruses and greatly reducing the chance of continued transmission among children.

With eradication strategies, the focus is on the effect of community protection in a very short period of time. The experience of campaign administration of OPV in other parts of the world has proved this premise and is described in more detail in the next chapter. The manner in which the vaccine is delivered becomes the most critical factor in predicting whether polio eradication can be achieved.

A dose at birth is highly recommended in endemic areas if the delivery is attended by trained personnel; it is not counted as part of the primary series and is referred to as "OPV Zero." Longer intervals than the recommended 4-8 weeks between doses do not require restarting the schedule. Polio vaccine may be given simultaneously with any other childhood immunization.

4.3 OPV Coverage

Immunization coverage can be monitored through two methods: the routine reporting system and coverage surveys. Vaccination coverage should be analyzed regularly at the village/town, PHC and district level. Where possible, birth cohorts should be closely monitored on a monthly basis.

Coverage surveys are helpful in places where a significant number of immunizations are given through the private sector or when tracking or reporting systems are not sufficient to provide coverage data.

In case coverage surveys reveal the coverage to be lower than 80%, catch-up rounds should be planned and implemented to increase the coverage.

5.0 ACUTE FLACCID PARALYSIS

Acute flaccid paralysis means that paralysis is of acute onset (< 4 weeks) and the affected limb or limbs are flaccid, i.e. floppy or limp. Tone is diminished as evidenced by examination by palpation or passive movement of joints.

It should be stressed that surveillance is carried out for all cases of acute flaccid paralysis (AFP) and not just for poliomyelitis. Therefore, all AFP cases should be reported, regardless of the final diagnosis. Because paralytic poliomyelitis is one cause of AFP, maintaining a high sensitivity of AFP reporting will ensure that all cases of paralytic poliomyelitis are detected, reported, and investigated, resulting in preventive control measures to interrupt transmission of disease.

Historically, poliomyelitis has often been referred to as infantile paralysis. However, any case of AFP, regardless of the age, should be reported and investigated if poliomyelitis is a possible cause. Occasionally, poliomyelitis may occur in older children. Therefore, AFP surveillance must focus on children aged <15 years, it must be flexible to capture the occasional case that may occur in older children. It should also be noted that AFP in a child aged >15 years is unlikely to be polio.

Experience in other parts of the world indicates that at least 1 case of AFP occurs for every 100,000 population children aged <15 years per year. This is referred to as the "background" rate of AFP among children. The other non-polio causes of AFP, such as Guillain-Barre Syndrome (GBS), transverse myelitis (TM), traumatic neuritis (TN), account for this background rate, regardless of whether acute poliomyelitis exists in the community.

Based on the estimated population of children aged <15 years, the following table expresses the number of expected AFP cases that should be detected and reported in each state, regardless of whether polio is endemic. For example, if an area has 10 lakh children <15 years of age, then at least 10 AFP cases should be reported each year [(population <15 years of age)/(100,000)]. The goal in India is to have all districts reporting AFP rates of at least 1 case per 100,000 population of children aged <15 years. Reported AFP rates less than this would suggest that surveillance is not sensitive enough to detect all cases of paralytic poliomyelitis.

Special effort should be made to obtain stool samples from AFP cases, and outbreak response efforts should be started promptly without waiting for the stool culture reports which may take 4 to 8 weeks. All cases that are classified as "discarded", not polio, require thorough justification and should be reported with final diagnosis.

EXPECTED NUMBER OF AFP CASES BY STATE (@ 1/100,000 POPULATION <15 YEARS)		
State or Union Territory	**Population <15 (000's)**	**Expected # Non-polio AFP**
Arunachal Pradesh	366	4
Assam	9260	93
Manipur	771	8
Meghalaya	743	7
Mizoram	304	3
Nagaland	536	5
Sikkim	181	2
West Bengal	27302	273
Tripura	1156	12
Chandigarh	307	3
Delhi	4271	43
Haryana	6796	68
Himachal Pradesh	2110	21
Jammu and Kashmir	3203	32
Punjab	8029	80
Andhra Pradesh	26757	268
Karnataka	17842	178
Kerala	11465	115
Pondicherry	333	3
Tamil Nadu	21425	214
D&N Haveli	59	1
Goa	479	5
Daman and Diu	42	1
Gujarat	16689	167
Maharashtra	32262	323
Rajasthan	18106	181
Madhya Pradesh	27055	270
Orissa	12823	128
Bihar	35753	358
Uttar Pradesh	56062	561
Total	**342487**	**3427**

6.0 AFP CASE CLASSIFICATION

It should be stressed that surveillance is carried out for all cases of acute flaccid paralysis and not just for poliomyelitis. Special effort should be made to obtain stool samples from **all** AFP cases, and intensified outbreak response efforts should be started promptly without waiting for the stool culture reports which may take 4 to 8 weeks. All cases that are classified as "discarded" require thorough justification.

> ***Surveillance is carried out for all cases of acute flaccid paralysis, not just for poliomyelitis.***

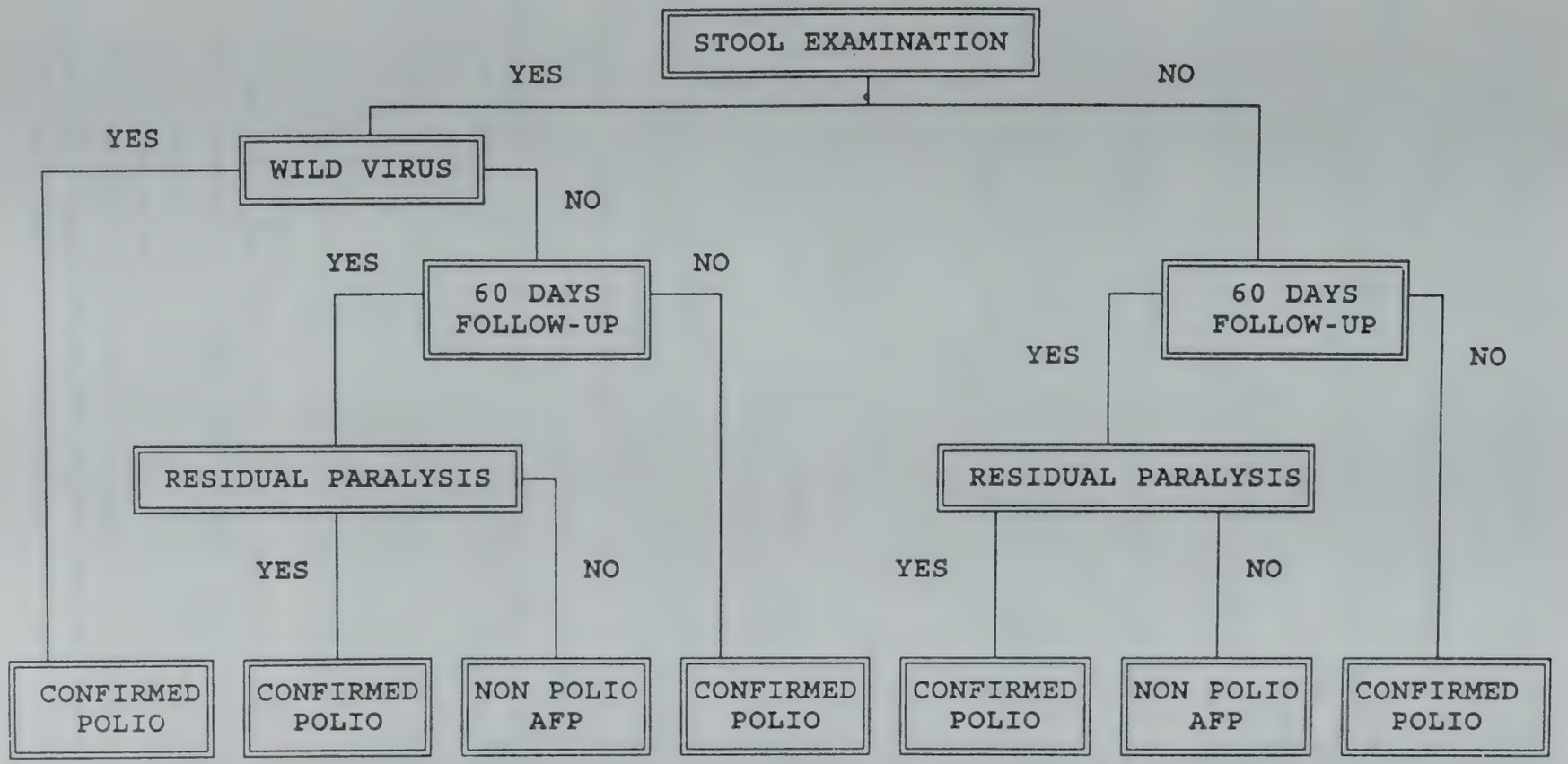
A suspected case is any case of acute flaccid paralysis in a person under 15 years of age for any reason other than severe trauma, or paralytic illness in a person of any age in which polio is suspected. Therefore, the terms "suspected" polio and AFP are equivalent. In this manual, we recommend that the term "suspect" case be avoided and only the term acute flaccid paralysis or AFP be used.

The classification of AFP is temporary. Within 10 weeks of onset the case should be reclassified as "confirmed" or "discarded" as not polio. The table on page 10 gives the criteria by which AFP cases are reclassified as confirmed paralytic poliomyelitis.

A practical classification scheme of AFP cases based on clinical and laboratory data is suggested below. Regardless of the scheme used, any case of AFP associated with wild poliovirus isolation from the stool should be classified as confirmed polio. This scheme hinges on importance of follow-up of the AFP case at 60 days after onset of paralysis and of the laboratory investigation. In the absence of follow-up all AFP cases are classified as confirmed polio. Despite being discarded as not being polio, all non-polio AFP cases must be reported with their final diagnosis, such as GBS or tumor. This is important to document the background AFP reporting rate, which indirectly monitors the sensitivity of the surveillance system.

> ***Cases of acute flaccid paralysis are confirmed as polio if they:***
>
> - ***are associated with isolation of wild poliovirus from the stools of the case; or***
> - ***have residual neurologic sequelae at 60 days after onset of paralysis; or***
> - ***died before follow-up could determine whether residual neurologic sequelae was present at 60 days after onset of paralysis; or***
> - ***were lost before follow-up could determine whether compatible residual neurologic sequelae was present at 60 days after onset of paralysis.***

ACUTE FLACCID PARALYSIS



Note: All AFP cases should have two stool samples collected 24 to 48 hours apart and within 14 days of onset of illness.

7.0 SURVEILLANCE

Reporting units must be identified to include all centers where paralytic cases might be brought for diagnosis, treatment, or rehabilitation. This network of reporting units will comprise the basic framework of the surveillance system.

At least one of these reporting units should be identified in each district. As a standard, when laboratory confirmed cases are no longer occurring, the goal should be to have a minimum of 2-3 reporting units per 100,000 population. However, the number of reporting units may vary widely, for example, some areas may have one reporting unit consisting of a hospital that adequately covers a large population, while other areas may require 10-15 units for adequate coverage. Each unit should be requested to report immediately if a case of AFP is seen. The steps for reporting include:

- **Network of AFP reporting units**: All health facilities, including hospitals, community health centers, and private nursing homes, likely to see AFP cases, must be listed and established as reporting sites. It is important that each one of these units report regularly (see monthly reporting below).
- **Initial identification and reporting of AFP cases**: Each reporting facility should identify one individual (and one or two alternates) who will be responsible for identifying and immediately reporting cases of AFP (including febrile paralytic disease, Guillain-Barre, transverse myelitis) to public health authorities. The designated person must report all cases of AFP immediately to the District Immunization Officer by the quickest means possible (telephone, telegram, or fax). Verbal communication should be followed by written notice as soon as possible. The DIO must record all AFP cases reported in a standard register in the form of an AFP line listing (ANNEX).
- **Initial investigation of reported AFP cases**: All reported cases should be investigated by District Immunization Officer within 48 hours after notification, in order to confirm clinical diagnosis and to obtain laboratory specimens of AFP cases and contacts. The District Immunization Officer should fill out the case investigation form, photocopy it, and send the copy to the State EPI Officer. The District Immunization Officer should initiate appropriate action for outbreak response when indicated. Information about outbreak response should be recorded on the case investigation form, photocopied, and sent on to the State EPI Officer.
- **60 day follow-up**: The District Immunization Officer must re-visit every case of AFP 60 days after the onset of paralysis to confirm the presence or absence of residual paralysis.
- **Monthly reporting**: At the end of each month, the DIO should report to the State EPI Officer the line lists of all new AFP cases reported to the DIO that month. This is done to summarize the activities of the DIO and to report on the current status of the investigation and follow-up of AFP cases. State EPI Officers will in turn report monthly to the national level. Reporting by the DIO and State EPI Officer should take place even when no cases of AFP have been identified (nil reporting). Eventually, the periodicity of reporting will need to be increased from monthly to weekly reporting.
- **Active surveillance**: One of the most critical units in the reporting system is the hospital. Case-finding through the emergency department, pediatric, and neurology wards, as well as through outpatient clinics, is critical to success for any surveillance system. The DIO should regularly visit these hospitals to ensure that AFP cases are reported, encourage reporting from private doctors, and to look for new cases. Apart from this, all health workers, Anganwadi workers, and traditional birth attendants must be encouraged to report AFP cases immediately to the nearest primary health center. The medical officer in the primary health center must in turn immediately alert the DIO.

KEYS FOR A SUCCESSFUL SURVEILLANCE PROGRAM

- ***The reporting system must cover key hospitals and clinics and have at least one reporting source for every geopolitical unit.***
- ***The concept of reporting all AFP cases rather than only poliomyelitis cases must be emphasized.***
- ***Monthly reporting of AFP is critical. Eventually weekly reporting will need to be done.***
- ***The concept of zero-case reporting of AFP must be included in the reporting system.***
- ***The reporting system for AFP must continually be monitored and revitalized.***
- ***Immediate response to reports of AFP by trained epidemiologists must occur for every suspected case within 48 hours.***
- ***Cooperation from the private medical community is essential for all surveillance efforts.***
- ***The public needs to be informed about the importance of and procedure for reporting AFP feedback to all participants of the surveillance system is essential.***

Surveillance officers will need to make special efforts to meet personally with busy hospital staff to obtain their cooperation and continued involvement in reporting AFP. One staff member should be identified as the contact person who is responsible for weekly to monthly reviews and reporting. It must be explained clearly to clinicians that even cases that are not likely to be poliomyelitis need to be reported if they fit the case definition of AFP and that adequate stool specimens must be collected from cases of AFP.

Educational campaigns for the medical community (particularly pediatricians, neurologists, orthopedists, and rehabilitation specialists) are needed to promote the knowledge that its cooperation and interest are essential to the eradication of polio.

Publicity campaigns for the public, including announcements, and the distribution of posters, TV ads, newspaper articles, public service should be carried out in order to increase the public's awareness of the polio eradication program, the need to vaccinate, and where to report cases of acute flaccid paralysis.

Every effort should be made to ensure that laboratory, epidemiologic, and operational personnel work closely and effectively together. Routine communications should be established with all local laboratories that may receive specimens from probable polio cases. Laboratory personnel should be instructed to notify the state surveillance coordinator immediately when specimens are labeled "paralysis," "Polio," "Guillain-Barre syndrome".

8.0 CASE INVESTIGATION AND OUTBREAK CONTROL

Each reported case of AFP should be investigated within 48 hours of being reported. Outbreak control should begin: as soon as one or more cases of AFP fit the definition of a probable case, that is, AFP is present and no immediate cause due to trauma can be identified; and after stool specimens have been collected (see guidelines for case investigation below). The outbreak should be reported immediately and all neighboring health units should be alerted and control immunization activities initiated immediately, so that transmission can be stopped. At the same time, it is important to intensify surveillance in order to find additional cases.

Outbreak control should cover the entire village in rural areas and the municipal ward in urban areas where the AFP case occurred. Before initiating immunization, stool specimen collection as a part of the case investigation should be done first. If the AFP case has traveled or had close contact with individuals from other areas of the country within the 40 days prior to the onset of paralysis, the State EPI Officer in those areas should be notified immediately. When appropriate, the MOHFW will alert the other countries. The opportunity should be used to inform the community about the importance of reporting AFP cases immediately.

The home of each AFP case should be visited and the case investigation form completed. A line listing of all AFP cases should be maintained. Inquiries should be made to determine whether other AFP cases have appeared in places the case had visited during the month prior to paralysis, such as a preschool center, school, or another town or village. For cases from rural areas, the investigator should inquire about the nearest large urban center or other site, such as marketplace or travel hub, that might be a likely reservoir.

All investigations should be carried out by the DIO initially and later if necessary by the State EPI Officer and/or other consultant epidemiologists.

The necessary steps in the investigation of all AFP cases are outlined below:

- Collect all available demographic and clinical information on the case.
- Fill out AFP case investigation form. Case investigation forms should be sent by the responsible DIO immediately to the State EPI Officer.
- Fill out an AFP case line listing form. Line lists of all AFP cases should be reported monthly to the State EPI Officer.
- Collect two stool samples 24-48 hours apart from the case. Stool cultures have the maximum chance of yielding a positive result if collected before 2 weeks after paralysis onset. Therefore, all efforts must be taken to collect stool specimens within 2 weeks of paralysis onset.
- Establish time and place for 60 day follow-up to determine if residual paralysis is present.
- Inform the neighboring DIOs in surrounding districts that an AFP case has been identified.
- If the onset of paralysis occurred less than 6 months earlier, initiate community investigation to identify additional cases.
- If the onset of paralysis occurred more than 6 months earlier, in the very least additional focus must be given to this area during the next PPIs.

Case finding during an outbreak: In order to find additional cases, procedures similar to those described in the chapter, Active Case Search, should be conducted. In conjunction, community leaders should be contacted and their assistance obtained. Door-to-door searches are an effective way to find the first additional cases, particularly in areas where patients are not likely to seek medical care.

Each temple, preschool center, school, hospital, clinic, drugstore, and rehabilitation center in the affected area must be identified and listed. A minimum of one visit should be made to each place. depending upon the extent of the outbreak and the personnel available (volunteers can be used), weekly contact is encouraged. During the first visit, health staff should be asked if any case of paralytic disease

had been seen or diagnosed within the last 6 months. If such cases occurred, the patient's medical record should be reviewed to determine if there is any possibility that the case was polio; if there is, the patient's home should be visited next.

In larger population centers, contacts may also include selected medical professionals, such as neurologists and pediatricians. Efforts to identify additional cases should extend well beyond the neighborhood or community in which the AFP case lives.

It is important that all stool specimens be collected prior to the start of special immunization activities; otherwise, vaccine virus may interfere with attempts to isolate the wild virus from these cases. Trivalent OPV is the vaccine of choice for containment vaccination. For purposes of polio eradication there are virtually no contraindications to OPV. The house-to-house campaign approach is the most effective method for outbreak control.

Target group: Children under 5 years of age should receive the highest priority to receive one dose of OPV, regardless of polio immunization history.

Each case of paralytic poliomyelitis probably represents 100 to 1,000 infected persons. As a result, the spread of the virus may be wider than the local area where the case resides. It should be emphasized that mass immunization programs with OPV have been shown to interrupt wild poliovirus transmission quickly; thus, immunization activities should cover a wide geographic area, particularly if there is any doubt about the quality of surveillance and/or vaccine coverage data. Adjacent areas may have coverage levels similar to the affected village or city, or there may be frequent or large-scale population movements. If so, immunization campaigns may need to be conducted in those areas as well. Such immunization activities should be organized promptly and publicized extensively.

When it is decided that outbreak control is necessary, certain information should be gathered and a plan of required actions developed. The following points should be considered in managing an outbreak.

- Population data - obtain most recent population size and distribution.
- What's been done - list any actions already taken.
- When did it start - listing of prior reports of cases in the area during the last 6 months. Construct an epidemic curve.
- What is the level of protection - coverage rate using existing data.
- Where are the cases - spot map to mark the location of case(s) and areas targeted for immunization on a map.

Resources: It will be important to determine what resources are available at all levels (transportation, vaccine, cold chain materials, etc.). Field staff to assist in outbreak control should include staff from other programs, district staff, medical and nursing students, and drivers. Arrange for transport and for travel advances.

Coordination: Keep the appropriate health/community authorities informed when and where the team will be arriving, and ask that specific health staff/community representatives be present.

Supplies: The necessary supplies to take to the outbreak area, include:

- Adequate vaccine, based on estimated target population.
- Cold chain materials: ice packs, cold boxes, vaccine carriers, vaccine monitors, thermometers. Determine if ice-pack freezing capacity is locally available or ice needs to be purchased commercially.
- Adequate supply of forms: line listings and case investigation forms (which includes a section for outbreak control summary).

Outbreak Monitoring: Information on cases, immunization activities, and villages visited needs to be updated continuously and monitored during an outbreak. This information should be kept on a form that can be summarized quickly, such as the Outbreak Control Summary.

9.0 VIRUS ISOLATION AND SPECIMEN COLLECTION PROCEDURES

Experience has shown that for purposes of eradication of wild poliovirus, stool specimen culture is by far the best diagnostic test. The following summarizes the different diagnostic tests available.

Stool: Virus usually can be found in the feces from 72 hours to up to 6 or more weeks after infection, with the highest probability during the first 2 weeks.

Cerebrospinal fluid (CSF): Not likely to yield virus, and therefore, its collection is *not recommended for culture.* However, the CSF cell count, gram stain, protein, and glucose may very useful in eliminating other conditions that cause AFP.

Throat: Not as likely as stool to yield virus and therefore specimen collection from this site is not recommended.

Blood: Not likely to yield virus, and current serologic tests can not differentiate between wild and vaccine virus strains. Experience has shown that, for polio, interpretation of serologic data can often be misleading. Collection of blood specimens for culture or serology is therefore not recommended.

> ***Isolation of wild poliovirus from stool is the best way to confirm the diagnosis of paralytic poliomyelitis.***

For all AFP cases, two specimens should be collected within 2 weeks after the onset of paralysis, 24 to 48 hours apart. The goal to collect specimens within two weeks of the onset of paralysis is important because if done later, virus excretion diminishes resulting in a reduction of the sensitivity of poliovirus detection.

Collection of large numbers of stool specimens in an outbreak setting will not be necessary for all cases encountered. Specimens from a few children should be sufficient to determine the cause of the outbreak.

Collection of contact specimens is generally not recommended, but may be needed in special circumstances.

> ***Before collecting stool specimens from contacts, make sure the child has not been fed OPV with the last 30 days.***

If a child with AFP dies, autopsy diagnosis of poliomyelitis may be best made within culturally accepted norms by sending a specimen of intestinal contents for viral culture (a rectal swab may be sufficient, however a larger amount, i.e. 8 grams, in a specimen container may facilitate virus culture). A diagnosis of polio may also be made or rejected by histological examination of the spinal cord. It is important that a qualified and experienced pathologist do the examination.

Specimens must arrive at the laboratory in good condition with ice which has not melted completely during transport. If specimens arrive with no ice, then the criteria for transport of specimens will not have been met. If wild poliovirus is present in the stool, its identification will be impossible if temperatures are not maintained in transport, requiring the maintenance of the "reverse" cold chain.

All specimen containers must be clearly labelled with the child's name, AFP case identification number (EPID number), and number of specimen (either 1 or 2). A line listing should be submitted along with the specimen. These specimen containers must be accompanied by the lab investigation form. The date of onset of illness and the date of receipt of the last dose of OPV must be clearly stated on the form. Other information to be included is the date of specimen collection and date of onset of paralysis. The

specimens cannot be tested unless such details are provided since these are necessary for the most accurate interpretation of the results and for epidemiologic analysis.

Each stool specimen should have the following information when sent to the laboratory:

- ***date collected;***
- ***case identification data;***
- ***city/town/village, district, state;***
- ***to whom the report should be sent;***
- ***clinical information especially date of paralysis onset;***
- ***OPV history;***
- ***date of last OPV dose;***
- ***correct identification on the specimen container.***

Stool specimens are contaminated material. The specimen should be placed in a clean container such as a wide mouthed plastic or glass bottle with a screw-on cap. These need not be autoclaved, but should be clean. Ideally, at least one "thumb-sized" (8 g) amount of stool is adequate. During storage, before despatch these should be placed in sealed plastic bags and stored separately from vaccines and other clean items. Storage should be in the freezer or any container that can maintain temperature below 8^{0}C until shipment has been arranged. A vaccine carrier with frozen ice packs can be used for this purpose. Packs must be replaced every day if transport is delayed. This vaccine carrier should be painted red to avoid the risk of its being mixed with other vaccine carriers used for the transportation of vaccines. These vaccine carriers used to transport stool specimens should never be used to transport vaccines.

Autopsy specimens may be indicated if a patient dies while in hospital. Intestinal fluid content is best for wild polio isolation, followed by neural tissue. For the transport of autopsy specimens care should be taken to avoid contamination of nervous system tissue with intestinal contents. Neural tissues should be collected using sterile instruments and placed in individual sterile containers. The pathologist should use separate instruments and containers for different tissue types. Specimens of the spinal cord are best for histopathology and should be obtained at all levels of the cord, including the medulla, cervical, thoracic, and lumbosacral levels. If possible keep all autopsy specimens refrigerated from the time of collection. Specimens should be clearly labelled with case or contact's name, case ID number, date of collection, date of onset of paralysis, and type of tissue or specimen.

Ideally, all specimens should be sent to the laboratory the day they are collected. Transporting one specimen at a time in some areas may prove to be too costly. After waiting a brief period sufficient specimens may have been collected to make the shipment more cost-effective. The DIO should not wait more than 2 days before shipping specimens to the State EPI Officer. The State EPI Officer should send specimens weekly to the laboratory. While awaiting shipment, specimens should be stored below +8 degrees C. Throughout transport, specimens must be packed to maintain temperatures below +8°C. One should not wait for the laboratory results to conduct immunization containment strategies. A decision should be made on the spot, regardless of whether laboratory results are available.

Messengers carrying field samples of OPV for potency tests can also carry faecal samples (in a separate vaccine carrier painted red) to the laboratory.

Unless the ice is replaced along the route as in hand-carried shipments, shipment from origin to destination should never take longer than 1-2 days. Care must be taken not to leave specimen containers in the sun during transit.

Maintenance of the "reverse" cold chain also requires advance notice to the laboratory with information regarding arrival time, site, mode, name of the courier company and the airway bill number, if sent by air. This should be done in writing with a FAX or TELEX, followed by a telephone call. Whenever

possible specimens should be hand-carried. When not hand-carried, air shipment is recommended. Shipping specimens close to a weekend, rather than early in the week is hazardous, because of the risk of being delayed in a airport over the weekend. The laboratory form mentioned above should also accompany the specimens to the lab. A follow-up check to ensure that shipment arrived in good condition is always recommended.

Specimen Collection and Handling

Area	Reported acute flaccid paralysis.
Specimen	8 grams of faeces (approximately one "thumb-sized" amount).
Number	Two specimens, taken 24 to 48 hours apart within 2 weeks of paralysis onset.
When	Within 2 weeks of onset, no later than 4 weeks.
Method	Voided faeces, preferably at least 8 grams.
Temporary storage	Less than +8° C
Transportation	Less than +8° C
Label	ID data (see lab form)
Collection Responsibility	DIO
Storage Responsibility	DIO and SEPIO
Transportation Responsibility	DIO and SEPIO
Responsibility for provision of specimen containers and specimen carriers	DIO, SEPIO, and Laboratory

Stool specimens are received, unpacked, and registered in the laboratory. They are stored at less than +8°C on a short term basis (a few days) and at -20°C for longer periods. They are stored under these conditions essentially until the laboratory is ready to begin culture procedures. The basic culture steps are summarized below for those who are interested.

Stools specimens are first diluted into a 10% stool suspension and then inoculated into cell cultures which are able to maintain the growth of polioviruses. Poliovirus causes a typical cytopathic effect (CPE) when observed in cell culture. For polioviruses, CPE usually occurs within 48 hours after inoculation, whereas other enteroviruses may take several days longer. Poliovirus is identified using enterovirus pooled antisera and further confirmed by doing a neutralization test using monospecific polio antisera. This primary identification indicates whether poliovirus type 1, 2, or 3 is present.

If appropriate, special tests are conducted to characterize vaccine-related from wild polioviruses. This process is called intratypic differentiation and is important in determining whether the paralysis was due to wild or vaccine-related polioviruses. This procedure for intratypic differentiation will only be available in two or three reference labs in the country and other labs need not do this procedure. The other labs can send their isolates to the nearest reference lab if it is needed.

A minimum of 28 days are required to isolate and identify polioviruses when one cell culture passage is successful in demonstrating the cytopathic effect of poliovirus. Difficult specimens require repeat cell culture passage, often because the presence of stool toxins in the specimen can make it difficult to interpret whether the observed cellular effect in culture is due to poliovirus or to the toxins themselves. Since the tests may not necessarily be conducted on the day the specimens are received, the results should not be expected before 6 weeks of the receipt of specimens at the laboratory.

Factors which influence isolation results, include intermittent excretion of the virus in the stool, insufficient material collected, collection too late in the course of the illness, inadequate storage and shipping procedures of specimens, and poor laboratory technique. The enterovirus isolation rate of stool specimens should be monitored, as this serves as an indirect indicator of the sensitivity of virus isolation at that lab. In tropical areas non-polio enteroviruses should be isolated from at least 10% to 15% of specimens in good labs.

The overall sensitivity for virus isolation from stools may be monitored by following the enterovirus isolation rate, which should be at least 10-15% of all stools tested. If the rate is lower, either there is problem with late or poor stool collection, inadequate "reverse" cold chain, or poor laboratory technique.

10.0 POLIO LABORATORY NETWORK

Because paralytic poliomyelitis is not clinically distinctive, it may be confused with other causes of flaccid paralysis. Therefore, extensive laboratory support is required to confirm or rule out wild poliovirus as the cause of acute flaccid paralysis. Techniques to process stool samples, isolate poliovirus, and differentiate between vaccine and wild virus have to be standardized, and the quality of this process needs to be monitored. To that end, the Ministry of Health has sponsored the formation of a network of laboratories within India. All of the labs perform stool sample analysis to detect poliovirus. Several of the more sophisticated labs perform intratypic differentiation tests for polioviruses.

Representatives of the network are encouraged to meet regularly to discuss the evaluation of testing methods, interpretation of findings, ways to improve network performance, implementation of new technologies, further collaborative research activities, and network resource and training needs. Virologists and epidemiologists need to maintain close contact to ensure that essential information on culture results get back to where they are needed in the field. The laboratories also need to communicate their requirements regarding the timely collection, proper storage, and safe shipment of the appropriate clinical specimens.

Guidelines for laboratories in the network include:

- ***Laboratories should be supplied with the reagents and materials needed to carry out polio diagnosis. They should also have the human resources necessary to carry out this task.***
- ***The laboratory should be aware of clinical and epidemiologic criteria that will aid in establishing priorities for processing the samples received by the regional laboratories.***
- ***Serologic testing of poliovirus antibodies should not be used because results are difficult to interpret and it is not possible to determine whether antibody is due to the vaccine or wild virus.***
- ***The laboratory should report results of stool sample analyses within 28 days.***
- ***Quality control measures for poliovirus isolation and identification (that is, coded samples) should be carried out in order to maintain a quality level of over 90% correct results.***
- ***Laboratories should implement adequate measures to prevent intra-laboratory viral contamination.***

11.0 PROGRAM SURVEILLANCE INDICATORS

There are several ways of assessing the sensitivity of surveillance. The two most critical are monitoring of the reported rate of AFP per 100,000 children <15 years of age and evaluation of weekly negative reporting.

Rates of AFP: Monitoring national rates of AFP is the principal way to evaluate the sensitivity of surveillance systems. A variation in rates between geographic areas may depend on environmental conditions. Nevertheless, based upon a number of previous studies, one would expect at least one case of AFP to be reported for every 100,000 children under the age of 15 years. Based on population data and the expected rate of AFP per 100,000 children <15 years of age, expected numbers of AFP cases that should be reported by State are shown in the table on page 5. This expected number of AFP cases that should be reported is based on the absence of polio. Therefore, in States which still have polio, the number of AFP cases reported should be higher than the expected number. In States where the reported AFP cases is less than the expected number, then under-reporting is most likely occurring.

Monthly negative reporting: Both the number of units reporting and the timeliness of the reports should be monitored on a monthly basis. As the program progresses and the number of cases decreases, the number of reporting units will need to increase. As a general rule, when no cases of paralytic polio are occurring, there should be at least five reporting sites per 100,000 population <15 years of age, although this number may be as small as one unit in some areas and as high as 15 in others. Negative reports may not reflect accurately the presence or absence of cases of acute flaccid paralysis among the population served by a reporting unit. In order to evaluate the reliability of monthly negative reporting of cases, interviews should be conducted with personnel involved in surveillance of acute flaccid paralysis at the regional level, as well as in selected districts and at individual reporting units within a state or area.

It is also critical to monitor surveillance performance with respect to the quality and timeliness of the AFP case investigations.

Percentage of AFP cases with 2 stools taken within 2 weeks after paralysis onset: This indicator not only monitors whether cases are investigated in a timely fashion, but also whether 2 stools are appropriately collected. This percentage should be 80% or greater. For purposes of wild poliovirus detection, this is one of the most important surveillance indicators to follow. Indeed, by knowing the AFP reporting rate and the percentage of cases with 2 stools taken within 2 weeks after paralysis onset, much can be said about the quality of surveillance in any particular area. Other indicators are described in more detail in the next chapter.

12.0 DATA ANALYSIS AND MONITORING

An important aspect of a successful polio eradication program is a well-developed information system-one which provides program managers and health workers with the necessary information to take appropriate actions. Information from the disease surveillance system is best used to produce regular summary reports as many states are doing now. These reports should be distributed to the personnel responsible for acting on the problems that are identified. All surveillance information should be standardized and include the same type of data elements.

The age distribution of cases is useful to establish what age groups to target for vaccination. In the Americas the vast majority of cases have been less than 6 years of age. In India, > 90% of the reported cases of polio are <5 years of age.

Cases should be plotted on a map according to their place of residence and the plot compared with coverage data and surveillance reporting sites. These maps can be useful for coordinating activities (such as vaccination points, etc.).

This information will help determine whether improvements in surveillance contacts are needed; for example, if cases are being reported only from rehabilitation centers, then additional clinic and hospital contacts may be required.

Accurate information on the vaccination history of persons with poliomyelitis is essential for evaluating vaccine efficacy and possible cold chain problems.

Monitoring techniques for performance of program strategies are outlined below.

Monitoring surveillance:

- Proportion of reporting sites reporting each week at least 80% of sites should report each month, even in the absence of cases.
- Sensitivity of surveillance-a minimum of 1 case of acute flaccid paralysis per 100,000 children < 15 years of age detected per year.
- Interval between case onset and notification-at least 80% of all cases should come to the attention of health/medical workers within 14 days of the onset of paralysis.

Monitoring investigations:

- Interval between notification of a suspected case and investigation - 80% of cases should have been investigated within 48 hours of notification.
- Case specimens - the proportion of AFP cases with two stool specimens collected within 14 days of the onset of paralysis and 24-48 hours apart should be at least 80% This is the ideal situation. The proportion of cases that two stools taken within 30 days should also be monitored.
- Interval between specimen collection and receipt by laboratory - 100% of specimens should be received by the laboratory within 3 days.
- Follow-up of case - at least 80% of all probable cases should be followed up at 60 days after paralysis onset to establish whether residual paralysis is present.
- Case investigation form - 100% of cases should have a completed investigation form with demographic, clinical, and laboratory information.
- Critical clinical variables - the records on all cases should include the following variables: date of paralysis onset, time or period of progression (installation) of paralysis, presence of fever at onset of paralysis, residual paralysis at 60 days after onset, atrophy at 60 days, location of paralysis (proximal or distal, symmetrical or asymmetrical), and final diagnosis.

Monitoring the laboratory:

- Condition of specimens - 100% of specimens received should be packaged in proper materials and be surrounded with ice.
- Interval between specimen receipt and results - 100% of results should be returned to the submitter with in 28 days.
- Recovery of virus - enterovirus should be recovered in at least 10-15% of the stools processed.

Monitoring control response:

- For 90% of all cases identified as probable or confirmed, control measures should begin within 72 hours of notification.

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Annexure 1

CLINICAL ASPECTS OF PARALYTIC POLIOMYELITIS

Paralytic poliomyelitis is still the most common cause of AFP in India. In the acute phase paralytic poliomyelitis presents as asymmetrical lower motor neuron flaccid paralysis. In India, the median age of onset of paralysis is 18 months and ranges from 3 months to 5 years, with the maximum occurring between 6 months and 2 years of age. There is a seasonal variation; maximum number of cases occur in the hot and humid season, i.e. April to August.

The major signs and symptoms are listed in the table below.

Major Signs and Symptoms of Paralytic Poliomyelitis In the Acute Phase
Acute onset
Fever just prior to paralysis - hallmark finding.
Muscle pain.
Asymmetrical paralysis.
Absent or diminished DTRs.
No sensory loss.

A hallmark of paralytic poliomyelitis is fever just prior to the onset of paralysis. The other associated symptoms are malaise, anorexia, nausea, vomiting, headache, sore throat, constipation, and abdominal pain. These might be signs of meningeal irritation, i.e. stiffness of neck and back muscles. Tripod sign may be present, i.e. the child finds difficulty in sitting and sits by supporting hands at the back and by partially flexing the hips and knees.

Progression of the paralysis to reach its maximum in the majority of cases occurs less than 4 days; however, a few may take 4-7 days. The paralysis usually starts from the trunk at the shoulder or hip and moving distally down the extremity. As it is asymmetrical patchy paralysis, muscle strength varies in different muscle groups of different limbs. However, proximal muscle groups are more involved as compared to distal ones. DTRs are diminished before the onset of paralysis. Cranial nerve involvement is seen on in bulbar and bulbospinal forms of paralytic poliomyelitis and is less common. There might be facial asymmetry, difficulty in swallowing, weakness, or loss of voice. Respiratory insufficiency can be life-threatening and may lead to death.

Diagnosis is confirmed by isolation of wild poliovirus from the stool specimen. In polio, the spinal fluid is inflammatory and it may or may not be under pressure. The fluid may be transparent or slightly turbid. Protein is increased moderately to 40-65 mg. From 20-300 cells per mm^3 are present with polymorphonuclear leukocytosis initially, but later shift towards lymphocytosis occurs.

Annexure 2

DIFFERENTIAL DIAGNOSIS OF ACUTE FLACCID PARALYSIS (AFP)

Guillain-Barre Syndrome

GBS is another common cause of AFP in childhood. GBS is an acquired demyelinating disease of the peripheral nervous system with the major features of weakness and areflexia. There is a history of fever about 2-3 weeks prior to illness. The paralysis in GBS is flaccid symmetrical paralysis with absent or diminished DTRs. In general, the paralysis of GBS occurs is ascending, affecting lower limbs first, followed by trunk, then upper limbs. Bilateral cranial nerve involvement is common. Facial nerve involvement is most common. Difficulty in swallowing secondary to 9th and 10th cranial nerve involvement is the second most common. Often children complain of pain and muscle tenderness at the onset. Sensory deficit is frequently present but is difficult to illicit in children.

Reported annual incidence rates of GBS in Latin America was highest in the age group 1-4 years with a mean 0.9/100,000 population 1-4 years of age. GBS also causes disease in older adults. The clinician should be aware that some age overlap exists between cases of paralytic poliomyelitis and GBS.

Children with GBS often complain of hypesthesia or anesthesia in a glove-stocking distribution. Tingling and burning sensations in the soles and palms are also frequent, as well as cramps in peroneal muscles; however, the child with GBS is not disturbed by handling or changes in position as is the child with polio.

Electrophysiologic study is preferably performed 3 weeks after onset of flaccid paralysis. Electromyography in GBS remains normal or minimally abnormal in severe cases. In GBS the demyelination of the peripheral nerves greatly reduces their impulse conduction velocity but does not stop the conduction altogether. In GBS sensory nerve conduction time is also slow.

The most important feature is an increase in protein up 200 mg, with a cell count of usually 10 or fewer monocytes per mm^3 of CSF. **A CSF white count of 50 or more is strong evidence against the diagnosis of GBS.**

The prognosis of GBS is good. Complete recovery occurs in the majority of cases. However, sequelae in children with GBS may be present at 3 months after onset of paralysis and consist of bilateral foot drop, weakness of grip, wrist drop, symmetrical atrophy of peroneal and anterior tibial muscles in legs, and atrophy of thenar and hypothenar eminence in palms.

Differentiating features from paralytic poliomyelitis are:

- Age: maximum number of cases of polio occur below 3 years of age, while in GBS more likely to occur above 2 years. There is age overlap at 3-4 years for both diseases. GBS is very rare in children < 1 year of age.
- Fever: in polio fever is typically present just prior to the onset of paralysis, while in GBS its is 2-3 weeks prior.
- Paralysis: in polio paralysis is asymmetrical and initially involves large proximal muscles. In GBS, paralysis is symmetrical and usually involves distal smaller muscles. In GBS the paralysis is ascending from the feet, while in polio it is descending from the shoulder or hip muscles.
- CSF findings: in polio CSF shows 20-300 WBCs and protein is normal or minimally elevated. while in GBS WBCs usually < 10 and proteins are up to 200 mg.

Although not routinely done, some hospitals are equipped with electrophysiologic diagnostic equipment. The usual findings are:

- Nerve: Nerve conduction velocity may be normal in polio, but is reduced in GBS.
- EMG: Electromyography is highly abnormal in polio with signs of denervation and giant action potential, while in GBS its is normal or slightly abnormal. However, a normal EMG does not rule out polio.

Transverse Myelitis

Patients with transverse myelitis range from 4 years and above. Fever may be present before the onset of AFP, but rarely during onset. Paralysis is usually symmetrical in the lower limbs and is accompanied by profound anesthesia to all forms of sensation. The site of involvement is usually the thoracic cord, but can be lumbar, thoracic, or cervical. Arms may also be partially paralyzed, but this occurrence is not frequent. There is hypotonia and DTRs are absent in TM. The most common sequence of symptoms is flaccidity of legs, followed by loss of control of rectal and bladder sphincters. Recovery is related to onset: when onset is fulminant or rapid (within hours), recovery usually begins several weeks to months later, and neurologic deficits remain. In contrast, children whose paralysis took several days to develop to completion usually begin to recover 1 to 5 days after symptoms peak and may recover completely. Flaccidity gradually may change to spasticity after several weeks and areflexia may be replaced by hyperreflexia.

Differentiating features of transverse myelitis from polio are:

- Age: Maximum cases of polio occur below 3 years of age, while TM is mostly above 4 years of age.
- Paralysis: In polio paralysis is asymmetrical and mostly involves large proximal muscles, while TM paralysis is symmetrical and may involve trunk and both lower limbs.
- Sensory: In polio there is no sensory loss, while in TM there is marked sensory loss.
- Autonomic: In polio bladder retention my occasionally occur, while in TM there is marked dysfunction of the bladder and bowel sphincters.
- CSF: In polio abnormal, while in TM normal.

Traumatic neuritis

Traumatic neuritis caused by injections may lead to AFP of the lower extremity. The onset of AFP in the affected lower limb occurs from 1 hour to 5 days after injection in the gluteal region. Fever is usually present before the onset of paralysis as the injection is given for a preexisting febrile illness. The sequence is difficult to establish when several injections are applied in both gluteus muscles. AFP is usually accompanied by pain in the gluteal region or along the affected leg. Atrophy may appear 40 to 60 days later. Knee jerk is present. Ankle jerk is absent or diminished. Hip and knee strength is normal. The child walks with a foot drop. However, atrophy of a traumatic injection never reaches the degree seen in polio. Differences in calf circumference usually do not exceed 0.5 to 1.5cm. Rarely, children are affected in both lower limbs because injections were given in both sides. Sequelae are rarely severe and children gradually recover with physiotherapy within 3 to 9 months.

Differentiating features of traumatic neuritis (TN) from polio are:

- Age: Polio occurs mainly below 3 years of age, while in TN there is no age limit.
- Paralysis: In polio large proximal muscle groups are involved although any group of muscles may be affected and the DTRs are diminished. In TN only one leg is involved below the knee, knee jerk is normal but ankle jerk is diminished.

Differential Diagnosis of Paralytic Poliomyelitis				
Signs and symptoms	Polio	GBS	Transverse myelitis	Traumatic neuritis
Progression of paralysis	< 4 days, maximum 7	From hours to 20 days	From hours to 4 days	From hours to 4 days
Fever onset	Present	Absent	Absent	Variable
Flaccidity	Acute, asymmetrical, proximal	Acute, symmetrical, distal	Acute, lower limbs, symmetrical	Acute, asymmetric limb
Muscle tone	Diminished	Diminished	Diminished in lower limbs	Diminished in limb
DTRs	Decreased or absent	Absent	Absent in lower limbs	Decreased or absent
Sensation	Severe myalgia and back ache	Cramps, tingling, hypesthesia	Anesthesia of lower limbs	Pain in gluteal region
Cranial nerve	Only when bulbar and bulbospinal	Often present	Absent	Absent
Decreased respirations	Only when bulbar and bulbospinal	In severe cases	Absent	Absent
CSF: WBCs Protein	High WBCs Normal or slightly increased	< 10 WBCs High	Normal Normal or slightly elevated	Normal Normal
Bladder dysfunction	Transient retention	Sometimes	Present	Absent
Conduction velocity 3 wks	Normal, then slightly decreased	Abnormal, demyelination	Normal	Abnormal in sciatic nerve
EMG - 3 wks	Abnormal	Normal	Normal	Normal
Sequelae	Severe, asymmetrical atrophy	Absent or minimal	Moderate atrophy	Peroneal atrophy

Non-polio Other Enteroviruses

A number of other non-polio enteroviruses are known to cause AFP. Many of the Coxsackie A viruses, most of the Coxsackie B and ECHO viruses, Enterovirus types 70 and 71, as well as the mumps virus, have been temporally associated with both mild and severe neurolytic disease. Although most cases show a course of improvement with complete recovery, in some cases sequelae may mimic paralysis caused by wild poliovirus. Because healthy children excrete other non-polio enteroviruses, the isolation of non-polio enteroviruses from patients with AFP may not be proof of causal relationship.

Other conditions

Other peripheral neuropathies that present as flaccid paralysis are caused by metabolic defects (diabetic), toxins (including lipid solvents and fish toxins), organophosphate pesticides, raw metals (lead), several pharmacological products, hereditary disease (Charcot-Marie-Tooth), diphtheria toxin, and tick bite. The clinical picture of post-diphtheritic paralysis is similar to GBS. However, it may be differentiated by prior history of sore throat, nasal twang, and nasal regurgitation of fluids about 2-7 weeks before onset of paralysis.

The paralytic sequelae of polio are generally more severe and permanent, atrophy of muscles and shortening of one lower limb may be present. Other causes of AFP paralysis tends to resolve or improve within 60 days of onset.

Tumors may lead to acute flaccid paralysis which is asymmetrical. Progression is usually slow and generally there is no fever associated with paralysis onset. Distribution of nerve involvement is dependent upon the anatomic location of the space occupying lesion.

> ***The differential diagnosis of acute flaccid paralysis is quite extensive and in order to manage effectively children with poliomyelitis the clinician must be fully aware of the other causes of acute flaccid paralysis so that he neither misses the diagnosis or over-diagnoses polio. The importance of 60-day follow-up and stools for viral culture is paramount.***

Diagnostic dilemmas

The differential diagnosis of AFP may at times be quite confusing, even in the best of hands. Difficulties arise particularly with 2-5 year-old children, who present with paralysis of both lower limbs. In this example, the history of fever is not definite. There may have been a mild URI, or GI disturbance before the onset of paralysis. The paralysis is of sudden onset and parents are unable to define whether it is ascending or descending. Slight asymmetry may be seen in GBS, also. Sensory loss, though specific for GBS, is not always possible to elicit in children. In this example, the CSF exam is useful, but if traumatic further delays diagnosis. Stool specimens will be helpful, but results are not available for 2-3 weeks. The clinician should re-evaluate confusing cases at more frequent intervals, perhaps after 2-3 days or after a week, and not hesitate to obtain second opinions. Electrophysiologic studies can help, but it will not always be possible to get them done.

Other dilemmas occur when children present with generalized paralysis, which is rapid in onset and progression, and has cranial nerve involvement. Unilateral facial nerve involvement favors the diagnosis of paralytic poliomyelitis, rather than GBS. Sensory loss will favor GBS. Children < 1 year of age should be checked for hypokalemia. In general, in children < 1 year of age with AFP the clinician should be keenly aware of other treatable causes of paralysis and "pseudo" paralysis, such as scurvy, congenital syphilis, and hypokalemia.

In a child with unilateral lower limb involvement, diagnosis may be confused with traumatic neuritis. Although not as common, paralytic poliomyelitis may present with weakness of the anterior tibialis leading to foot drop. Involvement of the gluteal and quadriceps muscles may be minimal. If the child in the supine position keeps the affected hypotonic limb in external rotation at the hip, paralytic poliomyelitis should be considered. A diminished knee jerk also supports the diagnosis of paralytic poliomyelitis. However, if the child is irritable, then reflexes may be difficult to elicit. A history of intramuscular infection in the gluteal area will favor the diagnosis of TN. In TN the knee jerk should be normal and the ankle jerk diminished. In general, residual paralysis of the lower limb which does not involve either the gluteus maximus, quadriceps, or anterior tibialis muscles is unlikely to paralytic poliomyelitis.

In summary, the examination of the sick child is by nature difficult. A difficult history from parents can make the less common, atypical presentations even more confusing. Second opinions should be obtained when the diagnosis is not clear. Other measures that can be taken to increase accuracy of diagnosis include: 1) obtaining stools specimens for culture on all patients with AFP, 2) completing the 60 day follow-up examination on as many cases as possible; 3) repeating the examination more frequently looking for an opportunity when the child is less irritable; and 4) establishing expert review boards to evaluate case records of difficult patients.

"Pseudo" paralysis

Certain conditions present with "pseudo" paralysis, which may be confused with AFP. **These conditions are not AFP and should not be reported as AFP.** Unrecognized trauma from contusions, sprains, or fractures are common sources of confusion.

Children with hypokalemia are toxic, irritable, and present with generalized acute flaccid paralysis of all 4 limbs and neck flop. It is caused by diminished potassium level in blood, especially in children with diarrhea and vomiting a few days prior to onset of paralysis. Weakness is noticed first in limb muscles, followed by weakness in trunk and respiratory muscles. Parents often bring their children in when the child becomes floppy and sudden neck flop is noted. Areflexia, paralysis, death form respiratory muscle failure and cardiac arrest can occur. Intravenous potassium drip save lives when the alert clinician recognizes this condition.

Children with non-specific toxic synovitis present with unilateral limp. Hip or knee joints are commonly affected. There is usually swelling of the joint and movements are painful. Low grade fever may persist for several days. Xrays may show fluid in the joint space.

Acute osteomyelitis shows localized signs of inflammation of the affected bone. There is polymorphonuclear leukocytosis. Xrays are diagnostically helpful.

Scurvy may occur at any age, but the majority of cases occur between 6 months to 2 years of age (like polio). The onset of symptoms is gradual. There is a history of irritability, digestive disorders, and loss of appetite. There is generalized tenderness and child resents handling. Pain leads to pseudoparalysis and legs are kept in frog position. In some cases subperiosteal hemorrhage may be palpated at distal end of femur. Gums show bluish-purple spongy swelling of mucous membranes, especially when teeth have erupted. Xray of knees is diagnostic. In early cases white line is visible at the distal end of femur and proximal end of tibia and fibula. In advanced cases zone of destruction on medial side of distal end of femur and proximal end of tibia is seen.

In acute rheumatic fever the clinical pattern is usually diagnostic. The arthritis is migratory and affects different joints, i.e. elbows, knees, ankles, and wrists. The affected joints are red, warm, and swollen.

Congenital syphilitic osteomyelitis is found only in early infancy. Xrays are diagnostic and include osteochondritis at wrists, elbows, ankles, knees, and periostitis of the long bones. Osteochondritis is painful and refusal to move the limb leads to pseudoparalysis.

Other conditions such as meningitis or meningoencephalitis can initially be confused with paralytic poliomyelitis; however, their etiologies are clarified after diagnostic procedures, such as lumbar puncture and biochemistries.

Postpolio syndrome (also called postpolio residual paralysis and postpolio muscular atrophy) refers to a group of disorders experienced by many poliomyelitis sufferers, typically starting 25-35 years after initial onset. Symptoms include renewed, usually gradual progression of muscle weakness, increased fatigability, joint pain, muscle cramps, intolerance to cold, and sometimes increased difficulty in breathing (when respiratory muscles are involved or severe scoliosis is present). Postpolio syndrome appears to be more frequent and severe in persons who had a more severe initial poliomyelitis illness. No single examination, procedure, or laboratory test can definitely diagnose this condition. There is no evidence to suggest that these patients are reinfected or have chronic infection; rather, they may be experiencing the consequences of long-term overuse or disuse to compensate for the original destruction of nerve cells.

Annexure 3

CLINICAL MANAGEMENT OF POLIOMYELITIS

Management of paralytic poliomyelitis in the acute phase is symptomatic. The child needs rest and care to ensure that there is no stress on the affected muscles. Care is also required to see that the child does not get secondary infections. **Massage and injections during this period are contraindicated.**

Uncomplicated cases of single lower limb or both lower limbs and trunk involvement can be treated at home. However, if poliomyelitis is suspected, such children should be examined by a physician as early as possible, to confirm diagnosis, rule out "high-risk" factors, such as early respiratory involvement, and for proper advice to parents on the care of the child at home.

Treatment of the Acute Phase of Paralytic Poliomyelitis
Complete bed rest.
Correct positioning of affected limb(s).
Passive movements of the joints.
Warm water fomentation.
Symptomatic treatment for fever and pain.
No massage or intramuscular infections.
Report immediately if progression of paralysis.

Complete bed rest is essential during the acute phase. There should not be any stress on the muscles involved. The mother or other persons caring for the child should frequently change the posture of the child in bed every two to three hours. The child should be placed on the stomach for short periods each day, to avoid the risk of pneumonia.

The limb should be placed in the optimum position for relaxation of the paralyzed muscles. The affected limbs can be positioned with pillows or rolled towels. The recommended positions are: hip- slight flexion; knee - 5 degrees flexion; foot - 90 degrees (support against the sole of the foot). Both legs should be supported from the lateral sides with pillows or rolled towels to prevent external rotation. Rolled towels should also be placed under the knee for positioning of hips and knees.

Joints of paralyzed muscles should be moved passively gently through full range of motion to prevent contracture. Such movements should be done for 10 minutes 2 to 3 times a day. The movements should involve all joints of the affected limb. The movement should be within the range of pain.

Warm water fomentation using hot packs with soaked towels wrapped around the affected parts for 10 minutes 2 to 3 times daily should be started as soon as possible and continued up to 6 weeks after onset of paralysis.

There is no restriction on diet and normal food may be given to the child if he accepts. Children may be constipated during this period. Transient urine retention may be noted which may be relieved

by alternate hot and cold compresses over the suprapubic region. However, if constipation lasts for 3 days or if there is no urine for 24 hours, such children should be immediately taken to a hospital

In 2 to 20% of the cases the outcome may be fatal due to involvement of muscles affecting vital functions, especially respiration. If the child shows any respiratory distress; if the paralysis is progressing and cases of upper limb involvement in the first week of illness should preferably be hospitalized. Indications for referral to the hospital are listed below.

Indications for Hospitalization
Progression of paralysis.
Respiratory distress.
Bulbar involvement.
Paralysis of upper limbs of < 3 days.
Marked drowsiness.
Other complications.

As the acute phase of illness subsides and recovery of strength begins, the emphasis shifts to active rather than passive movements and a vigorous program of physical therapy is initiated to regain muscle power. Management of the recovery phase begins with a careful assessment and recording of muscle power of the weak muscle groups to serve as a baseline. The degree of recovery ranges from minimal to complete. Maximum recovery of the affected muscles takes place in the first six months, but slow recovery continues up to two years. Physical therapy is necessary to prevent deformities and contracture due to muscle imbalance or improper posture. Physical therapy under a qualified physiotherapist is important for regaining muscle power and rehabilitation of the child.

Braces are used to compensate for weak muscle groups, eg. foot drop or more severe leg weakness. Children are fitted with braces (calipers) depending upon the age and degree of involvement of the limbs. Unilateral brace is given in case of a single lower limb paralysis by the age of one and a half years, when the child begins to start walking. Bilateral leg braces are prescribed for both leg paralysis by the age of 2 1/2 to 3 years of age. Children with bilateral braces need crutches. Bracing above or below the knee depends on the extent of paralysis. It can be extended up to the trunk in the case of trunk muscle weakness. Infants and younger children are also given abdominal support and jackets to help in sitting in case of trunk weakness.

Although further clinical recovery is not expected after two years, continued physiotherapy is required to prevent deformities. Contracture, denervation, or imbalance of muscle tension can lead to progressive skeletal deformities. Reduced growth of a denervated extremity is commonly seen. Tendon shortening can be largely prevented by active physical therapy in the weeks following acute poliomyelitis, but some cases will require orthopedic procedures. Tendon transplants may be considered to improve function of the hand or foot. Surgical interventions may be indicated for various forms of deformities. Orthotic appliances also need to be changed as the child grows.

Except for physical handicap of residual paralysis, children are otherwise normal and should be treated as such. They should be encouraged to take part in childhood activities and attend normal schools. The guidance of a pediatric physiatrist, occupational therapist, social worker, and a vocational councillor are helpful in promoting a positive approach and adjustment.

Management of non-polio causes of residual paralysis is similar to that for polio. In cases of transverse myelitis where sensory loss is severe, special care should be taken while giving splints and braces; otherwise, trophic ulcers may develop. During the acute phase, special emphasis is also required for skin care and posture because sensory loss, bladder and bowel dysfunction will increase the likelihood of the development of bed sores.

Annexure 4

INDIA STATE CODES

Name of State/Union Territory	Code
Arunachal Pradesh	AC
Assam	AS
Manipur	MN
Meghalaya	ME
Mizoram	MZ
Nagaland	NA
Sikkim	SI
West Bengal	WB
Tripura	TR
Chandigarh	CH
Delhi	DL
Haryana	HA
Himachal Pradesh	HP
Jammu and Kashmir	JK
Punjab	PB
Andhra Pradesh	AP
Karnataka	KA
Kerala	KE
Pondicherry	PD
Tamil Nadu	TN
D&N Haveli	DN
Goa	GO
Daman and Diu	DD
Gujarat	GU
Maharashtra	MH
Rajasthan	RJ
Madhya Pradesh	MP
Orissa	OR
Bihar	BI
Uttar Pradesh	UP
Andaman & Nicobar Islands	AN
Lakshadweep	LK

Annexure 5

ASSIGNMENT OF AFP CASE IDENTIFICATION NUMBERS

How are AFP Case Investigation Numbers Assigned?

Every AFP case must have a unique case investigation number that can be used to follow-up the case and track the stool samples and other information. The AFP case identification number, also called the "EPID" number, is assigned for this purpose.

The case investigation number consists of thirteen alphabetic characters and digits:

Example: IND - ## - ### - ## - ###

The first three characters identify the **country**, i.e. India (IND).

The next two characters identify the **State** where the case was detected and investigated.

The next three characters identify the **district** where the case was detected and investigated.

The next two digits identify the **year** *of paralysis onset* (e.g. 96, 97, 98 etc.). For example, a case with paralysis onset on 4 April 1996, and reported on 5 May 1996, is coded 96; a case with paralysis onset on 25 December 1997, and reported on 2 January 1998, is coded 98.

The next three digits identify the **number of the case** detected in that district in the calendar year (for example, the first case in each district will be 001, the second case will be 002, etc.).

Example of Case Identification Numbers: IND-TN-ABC-96-001

This is a Case Identification Number for the first case in 1996 from the district of "ABC" in the State of "Tamil Nadu" in India.

The two-letter identification numbers for the States and Union Territories are listed in Annex II, and the three-letter identification numbers for each district will be developed during the first national training workshops.

ACUTE FLACCID PARALYSIS
CASE INVESTIGATION FORM

Case Identification Number:
IND - __ __ - __ __ __ - __ __ - __ __ __

1. Report/Investigation Information:
Name of Investigator: _____
Date Case Reported: ___ /___ / ___
Title: _____
Date Case Investigated: ___ / ___ / ___
Office: _____

2. Case Identification: Patient's Name: _____
Sex: _____ Date of Birth: ___/___/___ Age: years___ months___
Father's Name: _____ Mother's Name: _____
Address to find child for followup exam in 60 days: _____
Village/city: _____ District: _____ State: _____
Permanent Address (if different): _____

3. Hospitalization: Yes/No Date of Hospitalization: ___/___/___
Name of Hospital: _____ Hospital Record Number: _____

4. Immunization History:
Total OPV doses received through routine EPI: _____
Total OPV doses received through NIDs: _____
Date of last dose of OPV (routine or NID): ___/___/___

5. Signs and Symptoms: Date of Paralysis Onset: ___/___/___
Number of days from onset to maximum paralysis: _____
Acute paralysis: Yes/No/Unknown
Flaccid paralysis: Yes/No/Unknown
Any injections during 30 days before paralysis onset: Yes/No/Unknown
Fever on day of paralysis onset: Yes/No/Unknown
Asymmetrical paralysis: Yes/No/Unknown Ascending paralysis: Yes/No/Unknown
Sensation loss: Yes/No/Unknown Descending paralysis: Yes/No/Unknown
Site(s) of Paralysis: right arm / left arm / right leg / left leg / other (describe): _____

6. Stool Specimen Collection:

	Date Collected	Date Sent	Date of Result	Laboratory Result (circle)				
Stool 1	__/__/__	__/__/__	__/__/__	P1 P2 P3	Wild/Vaccine	Pending	NPEV*	Negative
Stool 2	__/__/__	__/__/__	__/__/__	P1 P2 P3	Wild/Vaccine	Pending	NPEV*	Negative

* non-polio enterovirus

7. 60 Day Follow-up Examination: Yes/No Date: ___/___/___ if no, why? _____
Died? (circle): Yes/No if yes,date: ___/___ If died, cause: _____
Residual paralysis present: Yes/No
Site of Paralysis: right arm / left arm / right leg / left leg / other(describe): _____

8. Outbreak Response: Done: Yes/No If no, why? _____
If yes, date begun: ___/___/___ Setting: Urban / Rural
Target pop. <5 years: _____ Number <5 immunized: _____

9. Final Classification: Confirmed Polio: Yes/No If Discarded, why?
Criteria:
1. Virus Isolation: _____ 1. Guillain-Barre _____
2. Residual Paralysis: _____ 2. Transverse Myelitis: _____
3. Died: _____ 3. Traumatic Neuritis: _____
4. Lost to Followup: _____ 4. Other: _____

ACUTE FLACCID PARALYSIS
LABORATORY REQUEST FORM
(to accompany stool specimens to laboratory)

Case Identification Number:
IND ___ ___ ___ ___ ___ ___
(matches AFP Case Investigation Form)

PART I: To Be Filled Out by Case Investigator:

Report/Investigation Information:
Name of Investigator: _____
Date Case Reported: __ __ /__ __ / __ __
Title: _____
Date Case Investigated: __ __ / __ __ / __ __
Office: _____

Case Information:
Patient's Name: _____
Sex: ____ Date of Birth: ___/___/___ Age: years___ months___
Address : _____
Village/city: _____ District: _____
State: _____
Date of Onset of Paralysis: ___/___/___ Total Number of OPV doses received: _____
Date of patient's last dose of OPV (routine or NID): ___/___/___

Stool Specimen Collection:

	Date Collected	Date Sent to Lab
Stool 1	___/___/___	___/___/___
Stool 2	___/___/___	___/___/___

Name of Person to Whom Lab Results Should Be Sent:
Name of State EPI Officer: _____
Complete Address: _____
_____
Telephone Number: _____

PART II: To Be Filled Out by Receiving Laboratory

Date specimens received at laboratory: Stool 1 ___/___/___ Stool 2 ___/___/___
Condition of Specimens:* Good ____ Fair ____ Poor ____
Results of Virus Isolation: 1st specimen *(Circle)* **P1 P2 P3 NPEV Neg**
2nd specimen *(Circle)* **P1 P2 P3 NPEV Neg**
Date Results Reported to State EPI Officer: 1st specimen ___/___/___ 2nd specimen ___/___/___
Specimens Sent to Reference Lab: Isolates from 1st ____ 2nd ____
Date Referred to Reference Lab: ___/___/___
Comments: _____

Part III: To Be Filled Out by Reference Laboratory

Date specimens received: ___/___/___
Date Results Reported to State EPI Officer and Receiving Lab in Part II: ___/___/___
Results of Virus Identification:
Specimen 1:
P1 No/Yes Wild / Vaccine **P2** No/Yes Wild / Vaccine **P3** No/Yes Wild / Vaccine
Specimen 2:
P1 No/Yes Wild / Vaccine **P2** No/Yes Wild / Vaccine **P3** No/Yes Wild / Vaccine
Non-polio enterovirus: Yes/No Pending results: Yes/No
Negative for all viruses: Yes/No
Comments: _____

* Criteria for "good" condition: adequate volume, no leakage, no dessication, and temperature indicator or presence of ice indicating reverse cold chain was maintained.

Period of Report: Month of _____ Line Listing of AFP Cases State:_____

Epidemiology Officer:_____

Case ID Number	Name of Patient	DOB (1)	Address	OPV date (2)	Onset date (3)	Report date (4)	Inv date (5)	F1 date (6)	F2 date (7)	FU date (8)	FU res (9)	Lab res (10)	Final Class. (11)	Final Status (12)
IND-__-__-__-__-__														
IND-__-__-__-__-__														
IND-__-__-__-__-__														
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IND-__-__-__-__-__														

(1) Date of Birth

(2) Date of last OPV

(3) Date of onset of paralysis

(4) Date of report

(5) Date of case investigation

(6) Date of first fecal specimen collection from case

(7) Date of second fecal specimen collection from case

(8) Date of follow-up clinical examination

(9) Follow-up at 60 days: D = died, L = lost to follow-up, N = normal, R = residual paralysis

(10) Laboratory results: P = positive for poliovirus; N = negative

(11) Final classification: C = confirmed, D = discarded, E = polio-compatible

(12) Final status of patient: A = alive, D = deceased, L = lost to follow-up